FreifunkFinder- An Android Application to Find the Closest Freifunk Wi-Fi Nodes

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CN lab – WiSe 2015/2016

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*Logo adapted from : https://www.iconfinder.com/search/?q=wifi

Freifunk

- A non-commercial initiative for ***free*** wireless networks.
- Users share their internet access.
- Decentralized mesh network.
- A part of global movement for free infrastructure.

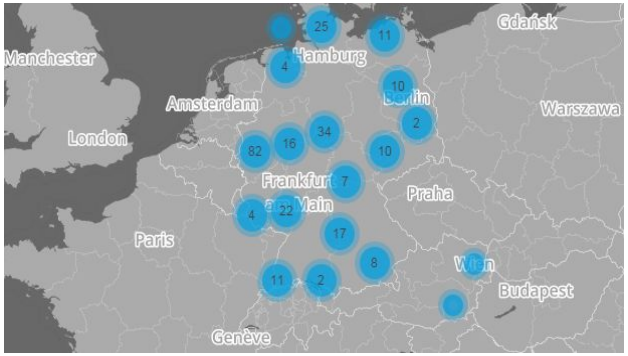

Image Source : https://freifunk.net

Motivation

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- **Problem**: Freifunk Wi-Fi nodes available all over Darmstadt, however user unaware of Wi-Fi nodes in vicinity. Solutions available but:-
  - Location and height parameters often ignored
  - Nodes displayed on a static map
  - Not so user-friendly

- **Our Solution**: An augmented reality Wi-Fi finder Android application to facilitate direction-oriented & user-friendly displays

Implementation- Block Diagram

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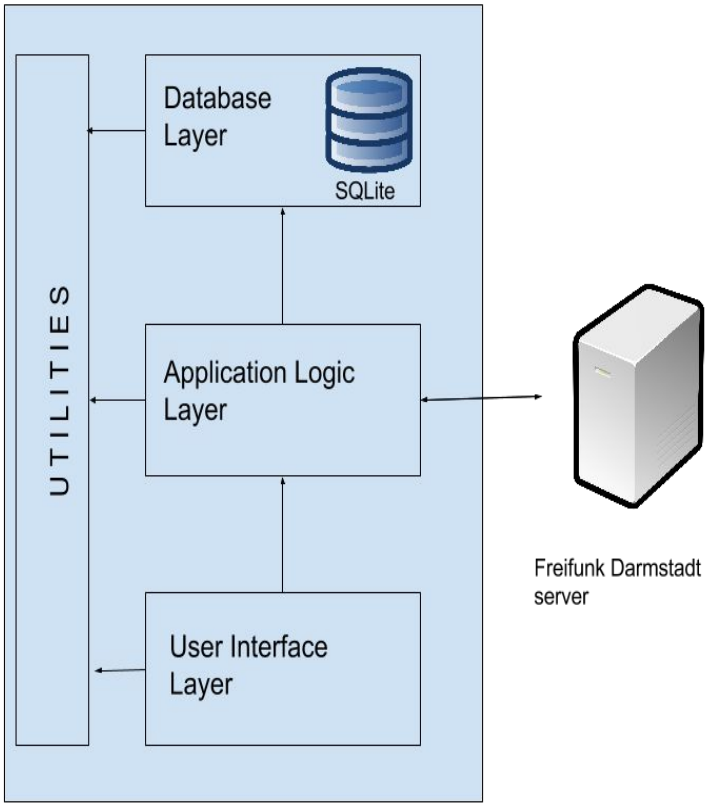
- UI Layer -
  - Sensor & Location managers
  - Camera View
  - Overlay View
- Application Logic Layer -
  - User-Node distance calculation
  - Sorting, Filtering based on user configuration
- Database Layer -
  - Interactions with SQLite
- Common Utilities -



Implementation - Sensors and Location

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Sensor Manager

- Uses Accelerometer and Compass
- Sensor data smoothing:

  >> Averaging over last 5 sensor values

  >> Exponential smoothing of calculated new value

  *newValue = oldValue + ex.coefficient * (newValue – oldValue)*

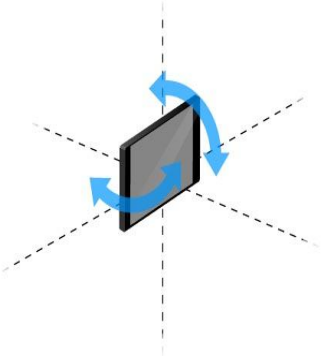

Image source: http://www.sitepoint.com/how-to-use-orientation-on-your-mobile-sites/

Location updates

- Register and listen for both GPS and Network providers
- Preference to GPS
- Time based frequent update for more accuracy

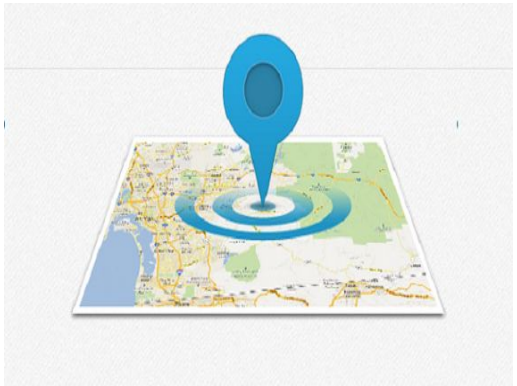

Image source: http://logodatabase.net/verve+mobile+logo

Implementation – Views

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- **FrameLayout for layering of views**
- **Camera View**
  - Camera content on a custom SurfaceView
  - SurfaceHolder Callbacks for implementing camera related steps
- **Overlay View**
  - Device's orientation calculation
  - Determining Wi-Fi nodes bearing and elevation from device's current orientation
  - Overlaying Wi-Fi nodes on a custom view

Image source : http://stitchroute82.exteen.com/20130423/online-learning-course-of-surveillance-webcams-in-schools

Image source : http://www.zagg.com/us/en_us/invisibleshield/glass-screen-protector

From User to Node - Distance calculation

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- Also called Great-circle distance.
- Calculated using Haversine formula.

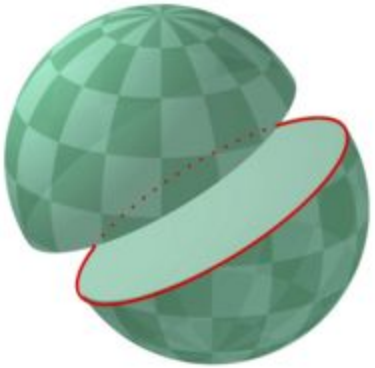


Image Source: https://commons.wikimedia.org/wiki/File:Great_circle_hemispheres.png

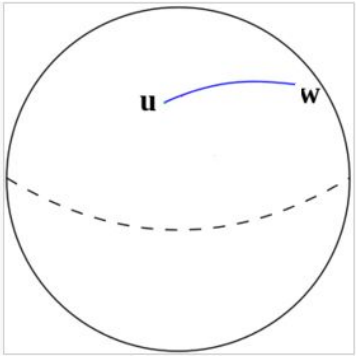
Let ϕ_1, λ_1 and ϕ_2 , λ_2 be the geographical latitude and longitude of two points 1 and 2, and $\Delta\phi$, $\Delta\lambda$ their absolute differences; then $\Delta\,\sigma$, the central angle between them, is given by :

$$\Delta\sigma = 2arctan\sqrt{sin^2(\tfrac{\Delta\phi}{2}) + \cos\phi_1 . \cos\phi_2 . \sin^2(\tfrac{\Delta\lambda}{2})}$$

The distance d, i.e. the arc length, for a sphere of radius r and $\Delta\sigma$ given in radians

$$d = r\Delta\sigma$$

Image and Formula Source: https://commons.wikimedia.org/wiki/File:Law-of-haversines.png



User Interface

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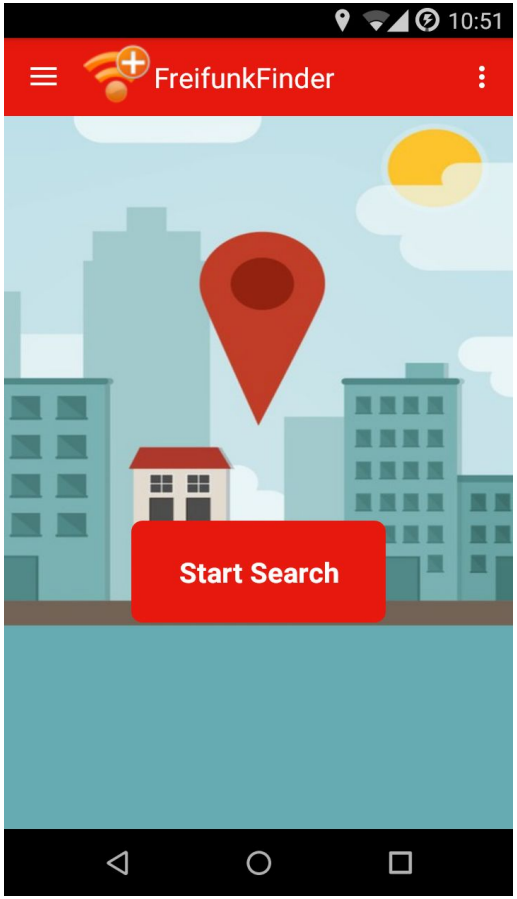

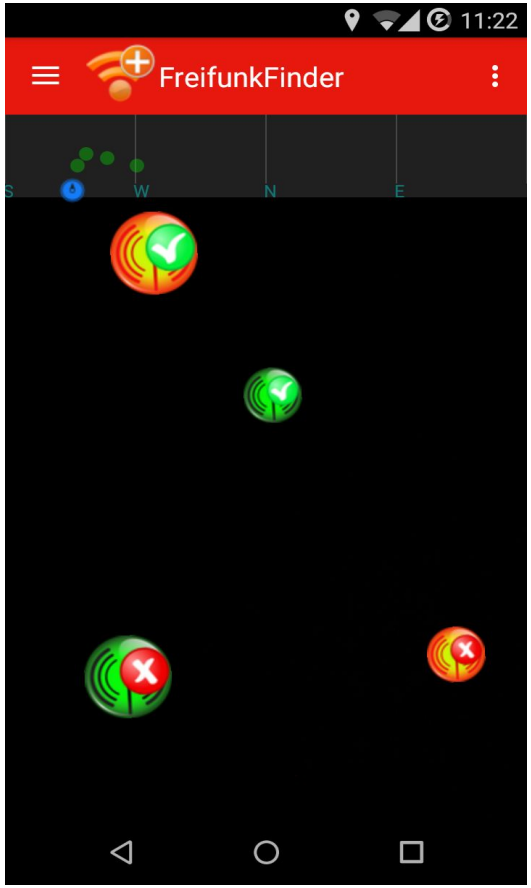

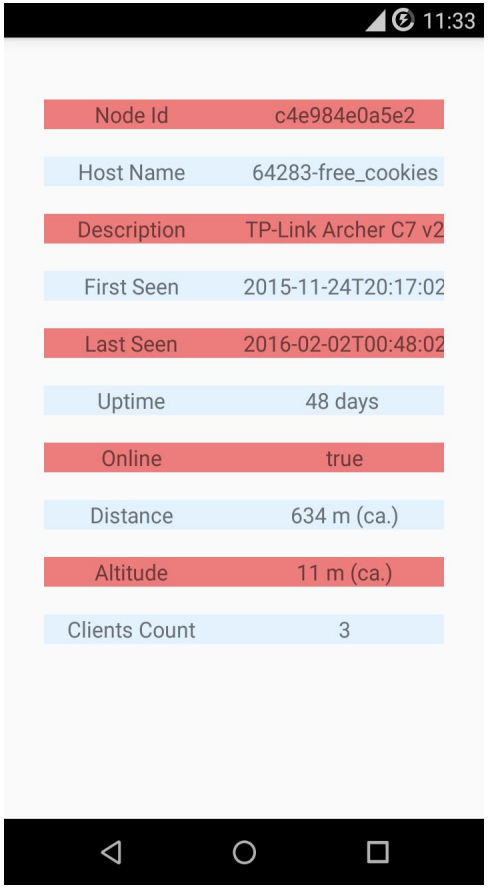

Rendered Node Information

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- Node is online

- Node is offline

- Altitude information is correct

- No altitude information available

All above icons vary in size based on if user is closer or farther from the node.

Summary & Conclusion

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- Successfully developed an android application that displays the available Wi-Fi nodes in an augmented reality fashion.
- Considered all three of the location parameters (latitude, longitude and altitude).
- Dynamically selects GPS/Network location provider based on availability.
- Provided user configurable parameters.
- Flexible design for future extensions.

Future extensions

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- Dynamic Wi-Fi strength rendering
- Sorting based on Wi-Fi strength
- Scope to add more locations

Thank you for your attention!

Questions?